

## 。 GDAŃSK UNIVERSITY OF TECHNOLOGY

## Subject card

Subject name and code	Finite element method, PG_00042224							
Field of study	Civil Engineering							
Date of commencement of studies	February 2025		Academic year of realisation of subject			2025/2026		
Education level second-cycle stu			Subject group			Obligatory subject group in the field of study		
						Subject group related to scientific research in the field of study		
Mode of study	Full-time studies		Mode of delivery			at the university		
Year of study	1		Language of instruction			English		
Semester of study	2		ECTS credits			4.0		
Learning profile	general academic profile		Assessment form			exam		
Conducting unit	Katedra Wytrzymałoś	> Faculty of Civil and Environmental			Engineering			
Name and surname	Subject supervisor		prof. dr hab. inż. Wojciech Witkowski					
of lecturer (lecturers)	Teachers							
Lesson types and methods	Lesson type	Lecture	Tutorial	Laboratory	Projec	t Seminar		SUM
of instruction	Number of study hours	30.0	0.0	30.0	0.0		0.0	60
	E-learning hours inclu	ided: 0.0						
Learning activity and number of study hours	Learning activity	activity Participation in didact classes included in st plan		Participation in consultation hours		Self-study SUM		SUM
	Number of study 60 hours		5.0		35.0		100	
Subject objectives	Getting familiar with base of Finite Element Method in theory (lectures) and practice (laboratory classes). Working in two different computational environments - ABAQUS, SOFiSTiK.							
Learning outcomes	Course outcome		Subject outcome			Method of verification		
	[K7_W03] has knowledge of Continuum Mechanics, knows rules of static analysis, stability and dynamics of complex rod, shell and volume structures, both in linear and basic nonlinear regime					[SW1] Assessment of factual knowledge		
	[K7_W04] has knowledge on advanced strength of materials, modeling and optimisation of materials and constructions; has knowledge of fundamentals of Finite Element Method and general nonlinear analysis of engineering constructions and systems [K7_U06] is able to choose proper					[SW1] / knowle	Assessment o dge Assessment of	f factual
	tools (measuring, analytical or numerical) to solve engineering problems, to acquire, filtrate, proces and analyse data					fulfilme	nt	
	[K7_U04] is able (using Finite Element Method), to define a calculation model and to perform advanced numerical analysis of complex constructions in: linear range and elementary nonlinear range, can criticaly evaluate the results of calculations.					[SU1] A fulfilme	Assessment of	task

Subject contents	FEM Codes, commercial, own-developed. Application of numerical method in theory of structures. Strong and weak forms, mechanics of continuum. Variational calculus. Variational principles of mechanics. Ritz method. FEM as a special case of finite dimensional approximation. FE discretization, interpolation. Models of finite elements, classification. Displacement formulation, selected finite elements, isoparametric formulation. Standard stages of FEM solution. Selected topics in application of FEM, verification and interpretation of results						
Prerequisites and co-requisites	BSP020 Structural mechanics BSP021 Computational methods						
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade				
and criteria	Test	60.0%	30.0%				
	Laboratory test	60.0%	70.0%				
Recommended reading	Basic literature	<ol> <li>RAKOWSKI G., KACPRZYK Z.: Metoda elementów skończonych w mechanice konstrukcji. Oficyna Wydawnicza Politechniki Warszawski Warszawa 2005.</li> <li>KLEIBER M (red).: Komputerowe metody mechaniki ciał stałych. Mechanika Techniczna t. XI. PWN, Warszawa 1995.</li> <li>DACKO M., BORKOWSKI W., DOBROCIŃSKI S., NIEZGODA T., WIECZOREK M.: Metoda elementów skończonych w mechanice konstrukcji. Arkady Warszawa 1994.</li> <li>ZIENKIEWICZ O.C.: Metoda elementów skończonych. Arkady 197 lub nowsze wydania w języku angielskim.</li> </ol>					
	Supplementary literature	<ol> <li>CHROSCIELEWSKI J., MAKOWSKI J., PIETRASZKIEWICZ W.: Statyka i dynamika powłok wielopłatowych. Nieliniowa teoria i metoda elementów skończonych. PAN IPPT, Biblioteka Mechaniki Stosowanej Serii A, monografie, Warszawa 2004.</li> <li>KREJA I.: Mechanika Ośrodków Ciągłych. Wydawnictwo CURE, Politechnika Gdańska, Gdańsk 2003.</li> <li>Adresy na platformie eNauczanie:</li> </ol>					

Example issues/ example questions/ tasks being completed	1. What are the sources of nonlinearity in mechanics, give examples.
	2. Why FEM is regarded as an approximation method?
	3. Explain the notion: linear elastic material.
	4. Write the expression for components of linear strain tensor.
	5. Name the problems of the Ritz method?
	6. Write the requirements that must be satisfied by shape functions.
	7. Explain the term: rigid body motion.
	8. Describe the possible disadvantages of using CST element.
	9. Describe the possible undesired effects of reduced integration.
	10. How do you understand locking effect?
Work placement	Not applicable

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